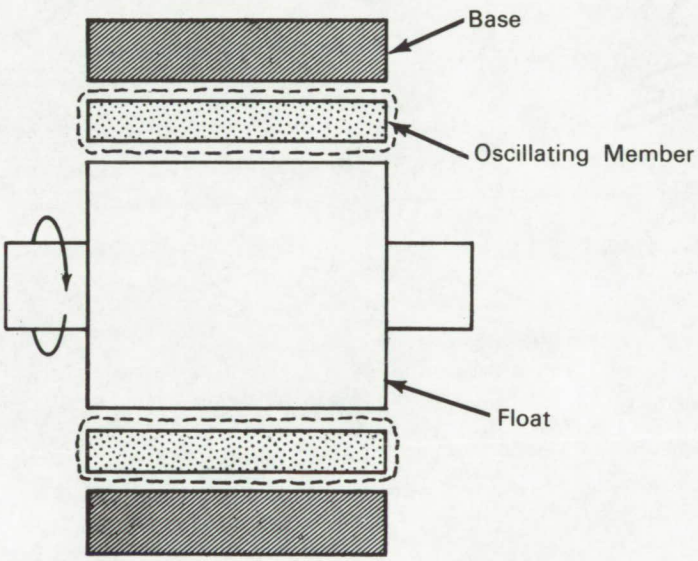
ATS - 132R

June 1966

Brief 66-10226

NASA TECH BRIEF

A Conceptual Design for Squeeze Film Bearings



The problem:

Squeeze film bearings require for their successful operation that at least one of two adjacent surfaces oscillate at high frequency and low amplitude so that the gap between the two surfaces changes dynamically. A strain-producing material (piezoelectric or magnetostrictive) which develops the required oscillation has been commonly used as an integral structural member of the bearing. An essential part of the design of such a bearing is the means for affixing the strain-producing member to the bearing base. If the strain-producing member is rigidly clamped to the base, it will have little freedom to oscillate and the symmetry and uniformity of the oscillation mode shape will be poor, resulting in impaired bearing effectiveness. On the other hand, if the strain-producing member is held to the base with very loose or compliant means, the stiffness of the bearing will be degraded (i.e., small changes in load will cause large deflections of the float with respect to the base).

The solution:

Support the oscillating (strain-producing) member on a double gas film as a means of resolving the conflicting requirements for affixing it to the bearing base.

How it's done:

In a double-film journal bearing, the float is supported on a gas film between the outer diameter of the float and the inner diameter of the oscillating

(continued overleaf)

member. The oscillating member then supports itself with respect to the base on a second gas film between the outer diameter of the oscillating member and the inner diameter of the base. The dashed lines in the illustration denote the extreme positions of the oscillating member.

The method is simple, because it only requires three parts. Another advantage is that the supporting force on the oscillating member is distributed relatively uniformly and symmetrically over a large area. Thus, a favorable compromise can be made between freedom of oscillation for the oscillating member and stiffness of the complete bearing.

Note:

This design is in the conceptual stage only; as of the date of publication of this Tech Brief neither a model nor a prototype has been constructed.

Source: Bendix Corporation
under contract to
Marshall Space Flight Center
(M-FS-573)